

## GENERAL CONDITIONS

### 1. GENERAL:

- A. Construction will not be allowed to begin until all criteria of the design review process have been satisfied and permission has been granted by the County's Utilities Construction Section.
- B. At the option of the Inspection Section, a preconstruction meeting may be required. Prior to beginning work, at least 48 hours advance notice must be given to the Inspection Section. Notification shall be given to the Chief Utilities Inspector at 748-1576.
- C. Where applicable, three copies of construction "cut-sheets" shall be submitted to the Utilities Department prior to the beginning of construction. "Cut-sheets" shall show centerline and offset hub elevations and amount of cut. Cut sheets are required on all gravity and force main wastewater projects, on water line projects where the final grade on future roads and paved areas can not be determined, and on projects where lines are installed in easements. Cut sheets are to be prepared by a qualified engineer or surveyor. Cut sheets shall consist of the following information:
  - 1) Temporary bench marks at each manhole.
  - 2) Each downgrade manhole is to begin with station 0+00 to readily identify the station of each service connection.
  - 3) Where the County is participating in the cost, elevations on centerline cuts are required every 25 feet.
  - 4) Centerline elevations every 50 feet and at every valve box and manhole location for water line projects where cut sheets are permitted and for force main projects.
- D. The Contractor shall be required to have all erosion and sediment control measures in place and approved before beginning clearing or construction.
- E. The Contractor is reminded of the requirements of permits issued by Chesterfield County, the Virginia Department of Transportation and other agencies and the obligation that the requirements of these permits be strictly adhered to.
- F. The Contractor is reminded that prior to the installation of water mains, the design engineer must certify in writing that:
  - 1) All pavement and shoulder areas within the right-of-way are graded to within 6" of subgrade.
  - 2) All ditches and slopes to 1 foot outside the right-of-way have been graded to final grade.

- 3) Markers for the sewer laterals are visible.
  - 4) All necessary property pins have been installed.
- G. It shall be the responsibility of the Developer or his agent to acquire offsite easements necessary for water or sewer installation. Developer shall adhere to any agreements negotiated with the landowner regarding restoration of the easement.
- H. Any work performed outside the boundary of a new subdivision and/or site development shall be considered work which the Developer, Engineer, and/or Contractor must comply with other requirements not covered in Part IV that are applicable such as the following sections:
- 1) PART III, Section 1 - Site Clearing
  - 2) PART III, Section 2 - Site Demolition
  - 3) PART III, Section 3 - Erosion and Sediment Control
  - 4) PART III, Section 7 - Establishing Vegetation
- I. The following specifications cover the construction of developer projects:
- Section 1 - Trenching, Backfilling and Compaction  
Section 2 - Sanitary Sewer Systems  
Section 3 - Water Distribution Systems

These specifications are to be used in conjunction with the County's Standard Details, county's [approved materials list and materials specification](#), and where applicable, any specifications and requirements as set forth in Part III - entitled "County Water and Sewer Projects Construction Specifications".

## 2. DEFINITIONS:

### A. COMPLETION:

Completion of work indicates that all sewer pipe, water pipe, valves, appurtenances, buildings, equipment and any other required items have been installed and appropriately tested in accordance with the plans, specifications and contract, all submittals including any O&M manuals have been made, all punch list items, right-of-way, easement, property and pavement restoration work has been completed as required. The use of water or wastewater lines by the contractor for the purpose of completing the testing of equipment or piping, the tie-in of water or wastewater lines, or the continued necessary use of equipment or piping because of tie-ins or testing shall in no way be construed as completion of work until the conditions of the first sentence of this definition has been satisfied.

**B. CONTRACTOR:**

The Developer's Agent, acting directly or through his agents, who has contracted to perform the work.

**C. COUNTY:**

The party of the second part to the County/Developer Agreement, Chesterfield County, acting through the Director of Utilities or his duly authorized agents.

**D. ENGINEER:**

The Consulting Engineer who has been designated by the Developer as Engineer in relation to the project, whether acting directly or through properly authorized agents, inspectors or representatives.

**E. FINAL INSPECTION:**

An inspection by the county inspector and contractor of all items covered by the County/Developer contract that results in a punch list of items remaining to be completed or submitted to satisfy the County's specifications.

**F. FINAL ACCEPTANCE:**

A written statement from the County to the Developer stating that as of a certain specific date all punch list items from the final inspection have been corrected and all necessary submittals have been made and the conditions of the County/Developer contract have been satisfied.

**G. INSPECTOR:**

The person appointed by the County's Director of Utilities to carry out instructions given by the County and to inspect the materials and work performed under this Agreement.

**H. SUBCONTRACTOR:**

Any individual, firm or corporation having a direct contract with the Contractor for the performance of any part of the work.

**I. WARRANTY PERIOD:**

A one year guarantee of equipment and labor by the Developer that begins on the date of final acceptance. (With a three year warranty on road work or in accordance with VDOT's latest requirements.)

**J. OTHER:**

Other definitions applicable may be found in the County's latest Utilities and Subdivision Ordinances and Part III of the County's Construction Specifications.

**3. LAWS AND REGULATIONS:**

The Contractor shall keep fully informed of all State and Federal laws and local ordinances, and regulations in any manner affecting those employed or engaged in the work, or in any way affecting the conduct of the work, and of all such orders or decrees of bodies or tribunals having jurisdiction or authority over same.

The Contractor shall protect and indemnify the County and its officers and agents against any claim or liability arising from or based on the violation of such laws, ordinances, regulations, orders or decrees, whether by himself or his employees.

Attention is called to Rules and Regulations Governing the Safety and Health of Employees Engaged in Construction as adopted by the Safety and Health Codes Commission of the Commonwealth of Virginia and all latest revisions thereto and issued by the Department of Labor and Industry.

The Contractor shall perform all construction operations in accordance with the U.S. "Occupational Safety and Health Act of 1970", the Standards of the U.S. Department of Labor, Occupational Safety and Health Administration and the latest amendments thereto.

**4. PERMITS:**

The Contractor must obtain all required licenses and permits and pay all charges and expenses connected with the work, and be responsible for all damages to persons or property which may occur in connection with the prosecution of the work.

Misunderstanding or ignorance of these laws on the part of the Contractor will not be considered as a valid excuse for his failure to secure the necessary permits.

**5. MATERIALS AND WORKMANSHIP:**

It is the intent of the County's specifications to describe definitely and fully the character of materials and workmanship required with regard to all ordinary features, and to require first-class work and materials in all particulars. For any unexpected features arising during the progress of the work and not fully covered in the County's specifications, County will require first-class work to be performed and materials to be used by the Contractor. It is understood that the County/Developer contract

includes any and all work that may be necessary to connect the work done with the adjoining work in a proper and workmanlike manner.

The County reserves the right to employ an independent testing laboratory to conduct tests of materials, etc. as the County may deem necessary to assure complete compliance with the requirements of the County's specifications. The Contractor shall offer full cooperation with personnel in the employ of the County in making these tests.

**6. NO DEVIATION FROM PLANS SPECIFICATIONS, ETC. BY THE CONTRACTOR:**

The Contractor shall not deviate from the plans, profiles, cross-sections and specifications in any particular except on written consent of the County. If deviation occurs on the part of the Contractor, he shall correct the error at his expense in a manner satisfactory to the County.

**7. OTHER PLANS AND WORKING DRAWINGS (SHOP DRAWINGS):**

Such information as is necessary to give a comprehensive idea of the construction contemplated, are shown on the plans. Contractor shall submit to the County Inspector and Engineer, for their approval, such additional detailed shop or working drawings as may be required for the construction of any part of the work. Pending the approval of such drawings, any work done or materials ordered shall be at the risk of the Contractor.

Working drawings shall consist of such detailed drawings as may reasonably be required for successful prosecution of the work, and which are not included in the plans furnished by the Engineer. These may include drawings for anchor bolts, centering and form work, masonry, layout diagrams, etc.

It is expressly understood that the approval of working drawings relates to the general concept and not the detail and such approval will not relieve the Contractor from any responsibility for errors or omissions in dimensions or quantities.

It is understood that Shop Drawings or Working Drawings processed by the Engineer are not Change Orders; that the purpose of Shop or Working Drawing submittals by the Contractor is to demonstrate to the County that the Contractor understands the design concept, to demonstrate his understanding by indicating which equipment and material he intends to furnish and install, and by detailing the fabrication and installation methods he intends to use.

If deviation, discrepancies, or conflicts between Shop Drawing submittals and the plans and specifications are discovered either prior to or after Shop Drawings submittals are processed, the plans and the County's specifications shall control and shall be followed. All Shop or Working Drawings and blueprints shall be made at the expense of the Contractor.

**8. DISCREPANCIES:**

Any discrepancies found between the plans and the County's specifications and site conditions or any inconsistencies or ambiguities in the plans or specifications shall be immediately reported to the Engineer, in writing, who shall promptly correct such inconsistencies or ambiguities in writing. Work done by the Contractor after his discovery of such discrepancies, inconsistencies or ambiguities shall be done at the Contractor's risk.

**9. CORRECTION OF WORK:**

The Contractor shall promptly remove from the premises all work rejected by the Engineer or County Inspector for failure to comply with the County's specifications, whether incorporated in the construction or not, and the Contractor shall promptly replace and reexecute the work in accordance with the County's specifications and shall bear the expense of making good all work of other Contractors destroyed or damaged by such removal or replacement.

All removal and replacement work shall be done at the Contractor's expense. If the Contractor does not take action to remove such rejected work within ten (10) days after receipt of Written Notice, the County may remove such work and store the materials at the expense of the Contractor.

**10. CHARACTER OF WORKMEN AND EQUIPMENT:**

The Contractor shall employ such superintendents, foremen and workmen as are careful and competent.

**11. SUPERINTENDENT:**

The Contractor shall personally supervise the work and when not personally present shall be represented by a Superintendent who shall have full authority to act as the Contractor's representative and all orders and instructions given to the Superintendent shall have the same force and meaning as if given to the Contractor in person. The Superintendent or Contractor shall be on duty at all times while the construction work is being done.

**12. RESPONSIBILITY OF CONTRACTOR:**

The Contractor shall take all responsibility for the work, and take all precautions to prevent injuries to persons and property in or about the work.

Until final acceptance of the work by the County, it shall be under the charge of the Contractor, and he shall take every care and necessary precaution against injury or damage to the work or any part thereof by the action of the elements or any other cause whatsoever, whether arising from the execution or the non-execution of the work.

The Contractor shall rebuild, repair, restore and make good, at his expense, all injuries or damage to work occasioned by any of the above causes before it will be accepted.

**13. WORK IN BAD WEATHER:**

During stormy or inclement weather, no work shall be done except as can be done satisfactorily and in a workmanlike manner to secure first-class construction throughout.

**14. WORK OUTSIDE REGULAR HOURS:**

If the Contractor desires to perform work outside the regular hours or on Saturday, he shall request permission to work 48 hours in advance to allow arrangements to be made for proper inspection. The County may refuse the Contractor permission to work if the 48-hours notice is not given or for other just cause. Reasonable efforts shall be made by the Contractor to avoid undue noise during the night and on Sundays, if it is necessary to work at such times. Under normal circumstances the Contractor will not be permitted to work on Sundays or County holidays.

The County reserves the right to schedule the Contractor to work outside normal working hours in the interest of public safety or convenience. Normal working hours are defined as 8:00 A.M. to 5:00 P.M., Monday through Friday.

**15. USE OF WATER:**

No water shall be drawn from the County's facilities for testing or other purposes until suitable arrangements have been made with the County Inspector.

**16. CONFLICTS:**

Should any requirements of the County's specifications conflict with the requirements of governmental or private authority having jurisdiction, then and to the extent of such conflict, these specifications shall be superseded.

**17. JOB SAFETY:**

The County shall not be responsible for the Contractor's safety precautions or to means, methods, techniques, sequences or procedures required for the Contractor to perform his work; such precautions include but are not limited to shoring, scaffolding, underpinning, temporary retainment of excavation and any erection methods and temporary bracing.

**18. EXISTING STRUCTURES:**

The location of existing sewers, water and gas pipes, conduits and other structures across or along the line of the proposed work are not necessarily shown on the plans, and if shown, the location, depth and dimensions of such structures may only be approximately correct. The Contractor shall have a working pipe locator on the job at all times.

The Contractor shall dig the necessary test holes for the purpose of locating existing underground structures. Such excavation shall not be undertaken without 48 hours prior notice to the County or owner of the existing facility.

**19. CARE OF EXISTING STRUCTURES:**

The Contractor shall be liable for all damage done to any structure or property arising through his negligence or carelessness. He shall take care of and maintain all underground, overhead or surface utilities encountered in the performance of the work.

Prior to commencing work Contractor shall contact the Utility Information Center ("Miss Utility"), telephone 1-800-552-7001 for assistance in locating existing underground utilities.

The Contractor shall observe all precautions with respect to fire and avoid the indiscriminate mutilation, or cutting down trees, within and outside of project work areas or easements. Any damage to property not in the work area or easements will be the Contractor's responsibility.

**20. INSPECTORS:**

The Inspector is authorized to inspect all work done and materials furnished. In case of any dispute arising between the Contractor and the Inspector as to materials furnished or the manner of performing the work, the Inspector will have the authority to reject material or suspend work until the question at issue can be referred to and decided.

The Engineer or Inspector shall have access at all times to all parts of the work being done for the purpose of inspection, measurements and establishments of lines and grades.

**21. RESPONSIBILITY OF CONTRACTOR'S EMPLOYEES:**

Each and every employee of the Contractor, and each and every one of his Subcontractors, engaged in said work shall for all purposes be deemed taken to be exclusive servants of the Contractor. The Contractor shall in no manner be relieved from responsibility or liability on account of any fault or delay in the execution of said work, or any part thereof, by any such employee or any Subcontractor or any material supplier whatsoever.



**22. FINAL INSPECTION:**

Before final inspection of the work, the Contractor shall clean up the site of the work including all rights-of-way, leaving it in as clean, neat and sanitary condition as originally found, and shall remove all machinery, tools, surplus material, temporary buildings, and other structures from the site of the work.

**23. STANDARDS FOR COMPUTING PAY ITEMS:**

Where the Developer is eligible for refunds, all pay items shall be based on the standards as outlined in Part III - "County Water and Sewer Construction Specifications".

**24. NOTIFICATION TO PROPERTY OWNERS:**

Contractor shall properly notify all property owners two (2) weeks prior to the start of any construction (including land clearing). Notification shall be in the form of a letter similar to the "sample" reflected in the County's latest Water and Sewer Specifications. (See sample "Notification" letter on Page [NOT-1](#) of Part III).

**25. WATER LINE TIE-INS:**

All water line tie-ins to the existing distribution system including vertical and horizontal relocations shall be coordinated with the Operations and Maintenance Section of the Utilities Department. Tie-ins shall be scheduled Monday thru Thursday from 9:00 a.m. to 4:00 p.m. Tie-ins may be required outside of this time and/or during nighttime hours.

The County reserves the right to require the Contractor to perform tie-ins outside of the normal working hours detailed above in the interest of public safety or customer service. No claim for additional compensation shall be made by the Contractor when such occasions occur.

Proper preparation including field verification of the plans shall be accomplished to minimize shutdown time and prevent the tie-in from exceeding scheduled shutdown time. Sufficient personnel, equipment and materials shall be on site prior to the water being shut off. Where applicable, excavation and preassembling of fittings shall be performed. If, in the opinion of the inspector, sufficient resources are not available, the tie-in will be cancelled and rescheduled.

Tie-ins to asbestos cement pipe shall be made to rough barrel pipe. Tie-ins to the machined section of asbestos pipe will not be permitted. Where asbestos cement pipe couplings have been removed, the machined end of the pipe shall be removed. Abandonment of cement asbestos pipe shall be per state and federal requirements.

Tie-ins involving fittings shall include provisions for temporary blocking until concrete blocking has cured.

All pipe and fittings used for a tie-in are to be swabbed with a 1% chlorine solution prior to connection.

## SECTION 1

### TRENCHING, BACKFILLING AND COMPACTION

#### I - GENERAL

##### 1.01 QUALITY ASSURANCE

Work shall conform to County of Chesterfield requirements and, where construction is within the State right-of-way, the applicable requirements of the Virginia Department of Transportation.

##### 1.02 SAFETY

It is a requirement of OSHA, VOSHA and these specifications that all safety measures including but not necessarily limited to trenching, confined space, traffic control and other applicable safety measures be strictly adhered to and enforced by the Contractor.

##### 1.03 JOB CONDITIONS

- A. Protection of Existing Utilities: It shall be the responsibility of the Contractor to conduct the work in such a manner as to avoid damage to, or interference with, any utility services. If such damage, interference, or interruption of service occurs as a result of his work, it shall be the Contractor's responsibility to promptly notify the County and utility owner of the occurrence and to repair or caused to be repaired the damage immediately, at his own expense, and to the satisfaction of the County and the owner of the utility. Further, it shall be the Contractor's responsibility to uncover and expose the location of all service connections to avoid damage or interruption of service. If damage occurs, the Contractor shall make the necessary repairs in accordance with the above requirements. It is also the responsibility of the Contractor to determine in advance of beginning his construction effort the exact location of all utilities, and the effect they will have on his work by contacting "Miss Utility" 48 hours prior to starting work, Telephone 1-800-552-7001 for assistance.
- B. Protection of Persons and Property:
  - 1. Barricade open excavations or work area shall be provided with warning lights and other protective measures as recommended by authorities having jurisdiction.
  - 2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by work or other operations in the area.

- C. Equipment used for this work shall meet all local, State and federal safety and any other applicable standards governing this work. All power machinery shall have adequate mufflers to keep noise to a minimum.

#### **1.04 COMPACTION**

It is the intent of these specifications that the Contractor be responsible for the correct bedding of utility lines, backfill of pipe trenches, and compaction of backfill as outlined in this section. Where (in the inspector's opinion) excavated material is not suitable for backfill, select backfill must be used.

The County may require that the Contractor have density and compaction tests performed by a certified independent laboratory verifying that the trench backfill has been compacted as required. Any material not compacted as required shall be removed at the Contractor's expense and replaced, recompact and retested. Any and all work performed by an independent laboratory is to be done under a purchase order from the Contractor. Verbal results of tests should immediately be given the Contractor and utility inspector. Two written copies of all reports by the independent laboratory confirming the field results shall be given to the inspector within (48) hours of the field tests. Requirements for compaction are covered in further detail later in this section.

Where water and/or wastewater utilities are to be installed in the paved area of new roadways to be accepted into the state system, the requirements of the Virginia Department of Transportation Chesterfield Residency compaction procedures are to be followed. The requirement applies to all new Tentative Plans submitted on or after September 1, 2001. For inspection and testing requirements see Non-Thoroughfare Plan Roadway and Thoroughfare Plan Roadway requirements in [Appendix A](#).

## **II - PRODUCTS**

### **2.01 SOIL MATERIALS**

Definitions:

- A. Unstable Soil Materials: Soil that is too wet to permit proper compaction.
- B. Non-cohesive Soil Materials: Non-cohesive soil materials include gravels, sand-gravel mixtures, and gravelly-sands.
- C. Cohesive Soil Materials: Cohesive soil materials include clayey and silty gravels, sand-clay mixtures, gravel-silt mixtures, clayey and silty sands, sand-silt mixtures, clays, silts, and very fine sands.

D. Backfill and Fill Materials:

1. Approved excavated or borrow materials must be free of rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, organic and other deleterious matter.
2. Approved materials must be at a moisture condition suitable for compaction at required density.

**III - EXECUTION**

**3.01 INSPECTION**

Examine the areas and conditions under which excavating, filling, and grading are to be performed and remedy any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the County.

**3.02 EXCAVATION**

- A. Excavation consists of removal and disposal of material encountered when establishing required trench elevations. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of County. Unauthorized excavation, as well as remedial work directed by the County, will not be compensated for by the County where refunds are involved.
- B. Unstable soil shall be removed to a depth determined by the County and replaced with No. 57 stone or other material approved by the Inspector which shall be uniformly and thoroughly compacted.
- C. Sheeting, Shoring and Bracing: Provide sheeting, shoring, and bracing as necessary to prevent cave-in of excavation or damage to existing structures on or adjoining the site.
  1. Establish requirements for trench shoring and bracing to comply with local codes and authorities having jurisdiction. The Contractor's attention is called to Rules and Regulations Governing the Safety and Health of Employees Engaged in Construction as adopted by the Safety and Health Codes Commission of the Commonwealth of Virginia and all latest revisions thereto and issued by the Department of Labor and Industry.

The contractor shall perform all construction operations in accordance with the U.S. "Occupational Safety and Health Act of 1970", the Standards of the U.S. Department of Labor, Occupational Safety and Health Administration and the latest amendments thereto.

2. Maintain sheeting, shoring and bracing in excavations regardless of time period excavations will be open. Carry down sheeting, shoring and bracing as excavation progresses in accordance with the proper authority.
  3. Sheeting, shoring and bracing may be left in place with the approval of the utility owner, but must be cut off to a depth of not less than two (2) feet below the surface.
- D. Dewatering: Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.
1. Do not allow water to accumulate in excavation. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations. Dewatering shall continue until backfilling has been completed.
  2. Convey groundwater and surface water removed from excavations to collecting or run-off areas approved by the County. Trenches shall not be used as temporary drainage ditches.
  3. All dewatering shall comply with the latest edition of the Virginia Erosion and Sediment Control Handbook.
- E. Stability of Excavations:
1. Slope sides of excavations to comply with local, State and Federal codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.
  2. Maintain sides and slopes of excavations in a safe condition until completion of backfilling.
- F. Material Storage: Stockpile approved excavated materials where approved by County, until required for backfill or fill. Place, grade, and shape stockpiles for proper drainage.
1. Locate and retain soil materials away from edge of excavations.
  2. Dispose of excess soil material and waste materials as hereinafter specified.

G.      Excavation for Trenches and Structures:

1.      Trenches shall be opened only so far in advance of pipe laying as the County will permit and in no case will this distance exceed 500 feet. The width of the trench at and below the top of the pipe shall not exceed the outside diameter of the pipe plus eighteen inches (18") except that for pipe twelve inches (12") or less in diameter, the trench width shall not exceed thirty-three inches (33"). The trench walls above the top of the pipe may be sloped or the trench above the top of the pipe may be widened as necessary for bracing, sheeting and shoring. Where these trench widths are exceeded, the Contractor, at his own expense, will be required to mechanically tamp an approved backfill material from the bottom of the trench to six (6) inches above the top of the pipe as directed by the County.
2.      Excavate trenches to the depth indicated or required. Carry the depth of trenches for piping to the indicated flow lines and invert elevations.
3.      Grade bottom of trenches as indicated. For pressure lines, notch under pipe bells to provide solid bearing for the entire body of the pipe.
4.      Where pipe for pressure lines is to be laid, the trench shall be in accordance with the County Standard Details.
5.      Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F.
6.      Excavation for structures shall conform to the lines and grades as shown, established or as necessary. Where the bottom of the excavation is in unstable material, such material shall be excavated to a depth of one foot below the bottom of the structure or to a depth required by the County and replace with No. 57 stone, coarse sand, or other material approved by the County. Bottoms shall be planked or covered with appropriate fabric if necessary to prevent the admixture of earth with the concrete. All sheeting, bracing, and shoring required for safety shall be installed in conformity with applicable rules and ordinances.

**3.03      HARDPAN EXCAVATION**

Hardpan is classified as indurated clay, shale or sand with acementitious material, which requires loosening with an air spade or blasting before it can be removed from the trench. The same clearances shall be made between the pipe or structure and hardpan material as is described hereinafter for rock excavation.

### 3.04 ROCK EXCAVATION

- A. Definition: Rock excavation shall comprise solid rock in the original bed or well defined ledges and which can only be removed by blasting and/or drilling or by the use of jack hammers, and shall include all boulders or detached pieces of rock one-half cubic yard or more in content.
- B. Pipe Trench: Rock shall be excavated a minimum of six (6) inches below the bottom of all pipes. The pipes shall be laid on a cushion of crushed stone of sufficient depth to provide the proper grade. A minimum clearance of six (6) inches shall be provided between the vertical walls of the trench and the bell of the pipe.
- C. Structures: Rock excavation for structures shall extend a minimum of eight (8) inches below the bottom or base of structure and a suitable bedding shall be provided. A minimum clearance of six (6) inches shall be provided between the rock and the exterior face of the structure when forming is not used. The minimum clearance shall be two (2) feet when forming is used.

### 3.05 BLASTING

- A. Blasting operations shall be in strict accordance with "Rules and Regulations Governing Manufacture, Storage, Handling, Use and Sale of Explosives" issued by the Department of Labor and Industry of Virginia and any County ordinances. All blasting shall be done at the sole risk of the Contractor and shall be done only by experienced licensed personnel. Occupants of nearby structures shall be notified prior to beginning blasting operations.
- B. When blasting is required, the Contractor shall conform to the following requirements:
  - 1. Blasting will not be permitted before 9:00 A.M. or after 4:00 P.M. on Monday through Friday.
  - 2. Blasting on Saturdays, Sundays or holidays will not be permitted.
  - 3. The Contractor will not be permitted to blast under any conditions unless a representative of the County is present.



4. The Contractor shall, each day when necessary to blast, set up an approximate schedule of blasting operations, and provide 24 hours notice to the County, and property owners with occupied buildings within 1000 feet of blasting.
5. The Contractor shall use mats to minimize noise impact on nearby residents.

### **3.06 BACKFILL FOR TRENCHES**

- A. General: After the installation of the pipe has been field inspected, the trenches shall be backfilled with fine, loose earth deposited carefully on both sides of the pipe or with the appropriate fill material specified on the trench detail or the County's Standard Details Section. Large clods, sticks, stones, and other unsatisfactory material must be excluded from the backfill around and to 12 " above the pipe. The fill or in the case of plastic pipe where stone is used for bedding and backfill to the top of the pipe, the stone shall be carefully rammed by hand or pneumatic tamping methods under, on both sides and to within 2-3 feet on top of the pipe. The remainder of the backfilling may be done by hand or with mechanical equipment in lifts no greater than 12 inches. Where settlement occurs, the trench shall be refilled, contoured and compacted by an approved method to conform to the surface of the ground. Sheeting and bracing shall, in general, be removed as the backfilling progresses, and in such a manner as to avoid caving of the trench. Voids left by the withdrawal of the sheeting or shoring shall be carefully filled and rammed. Where in the opinion of the County, damage is liable to result from the withdrawal of the sheeting, it shall be left in place. No rock should come in contact with pipe.
  1. Sewer pipe shall have minimum bedding as shown on the County Standard Details.
  2. Backfill shall be completed in layers with the following percentage of maximum density at optimum moisture content of  $\pm 2\%$  as determined by ASTM D698.
    - a. 95 percent under pavements and road shoulders.
    - b. 90 percent in other unpaved areas.
- B. Under Existing Roadways and Pavement: Backfill for trenches under roadways and other paved areas shall be backfilled to the top with 21-A stone, except that all fill above the pipe shall be deposited in layers not exceeding 6 inches in thickness. Each lift shall be thoroughly compacted by mechanical or hand tamping methods, in accordance with VDOT

requirements so that when the backfilling is completed, the paving may be replaced as specified in the section entitled Construction in Public Streets, Roads and Alleys.

- C. Clay dams: Clay material with an imperviousness of 10-3 cm/sec shall be used in clay dams. Material shall be compacted as indicated in paragraph A above. Inspector shall approve clay material prior to use.

### **3.07 BACKFILL FOR STRUCTURES**

Around and adjacent to structures, backfill shall be of material of suitable stability and perviousness. Backfill shall be placed in 6 inch lifts, each lift being compacted by an approved method. No backfill shall be placed against a structural wall until all connecting structural members are in place. It shall be the Contractor's responsibility to provide compaction to 95% per ASTM D-698. The Contractor shall provide adequate protection to all structures during backfilling and use every precaution to avoid damaging or defacing them.

### **3.08 CONSTRUCTION IN PUBLIC STREETS, ROADS AND ALLEYS**

Unless superseded by other specifications or VDOT permit requirements the following shall apply: The Contractor's operations in public streets, roads or alleys, shall be confined to as small a space as is practicable, so as not to cause undue inconvenience to the public or abutting properties, and shall be subject at all times to the approval of the County and Virginia Department of Transportation (VDOT). The word VDOT used in the previous sentence means the individual, group or governmental body that has jurisdiction over the streets, roads and alleys. Unless otherwise directed by VDOT, the Contractor shall perform the proposed construction on public streets, roads and alleys as follows:

**GENERAL:** Typically, water and sewer lines are to cross roadways at right angles and/or to parallel roadways in the roadway or along side the roadway. Uncased water lines are to be designed to have sufficient strength to withstand dead loads and superimposed live loads. All restoration materials and workmanship shall conform to the latest edition of the "Virginia Department of Transportation Road and Bridge Specifications" in addition to permit requirements. The contractor is responsible for obtaining all highway permits and forwarding a copy to the County or obtain a VDOT statement that no highway permit is necessary before construction can begin. Method of construction (trenching, boring, tunneling, jacking, etc.) must be shown on permit and plans. During construction, if deemed necessary by the VDOT to assign inspectors to the project, the contractor is to pay an additional inspection fee to cover

their cost. The contractor is responsible for identifying, locating, adjusting and/or relocating existing utilities, structures and survey markers (including making all the arrangements necessary to coordinate the work to be performed). To avoid unnecessary construction delays, the contractor needs to make application for a highway permit at least 10 working days prior to starting construction.

Nothing contained herein is intended, nor should be construed, to relieve the contractor in any manner whatsoever of his responsibility for maintaining trenches, pavement structure, shoulders and generally the work site in a manner acceptable to VDOT. Prior to the actual open cut, the VDOT is to be notified 24 hours in advance to arrange a meeting with their representative and the Utilities Inspector.

**BACKFILL AND COMPACTION:** Typically, backfill will be compacted to 950 of the theoretical maximum density at optimum moisture content, as determined by VDOT testing procedure VTM-1. The contractor shall provide adequate protection to all structures during trenching and backfilling using every precaution to avoid damage or defacement. Not over 500 feet of trench shall be opened at any one time. Backfill for water and sewer lines shall be placed generally in accordance with VDOT and County specifications and the following criteria:

- A. Prior to excavation of the trench and prior to the installation of surface course(s), the adjacent plant mix shall be smooth face cut through the full depth.
- B. No trench shall be backfilled until authorized by the County. Materials for backfilling from the bottom (Bedding per County Standards) of the trench to 12 inches above the water and/or sewer line shall be #57 stone bedding and backfill for sewer lines and VDOT Type B or approved sand for water lines. Material shall be thoroughly and carefully compacted to insure a sound backfill over and around the water and/or sewer line.
- C. Backfill shall be compacted by mechanical tamping throughout the depth of the trench in 6" layers to insure a suitable subbase, acceptable to the County and VDOT.
- D. Backfilling shall be performed in accordance with the standard details, latest revision, for pavement restoration applicable to the situation at hand.

**BITUMINOUS PAVEMENT STRUCTURE:** Wherever pavement is permitted to be cut as shown on plans, not over one-half of the road width shall be disturbed at one time, unless an approved method of detouring traffic is reviewed and accepted by Virginia Department of Transportation. The first opening shall be in travelable condition before the second half can be opened.

Where contractor is granted approval from VDOT to open cut a road, (**this applies to crossings only**) the permit will include the following stipulations but not limited thereto:

- A. Chesterfield Residency is to be notified 48 hours prior to any open cut work being performed.
- B. Work within the roadway shall be done between the hours of **9 A.M. and 4 P.M.** or as stated in the VDOT permit.
- C. Utilize proper sign layout and channelization devices (i.e., cones, plastic barrels, pavement marking, etc.) during construction, according to VDOT's "Virginia Work Area Protection Manual".
- D. The area of the open cut shall be restored in accordance with one of the following applicable standards:

1. **Asphalt Road**

- a. Backfill entirely with #21-A or #21 stone (95% compaction)
- b. Apply tack material to all joints, before placing surface mixture
- c. Install minimum 12" BM-25.0 asphalt concrete in 4" lifts (see [Standard Detail](#))
- d. Overlay a minimum of 25' on both sides of trench with 2" of surface mix
- e. Seal all joints with liquid bituminous sealer

2. **Asphalt Road Base with a Surface Treatment Seal**

- a. Backfill entirely with #21-A or #21-B stone (95% compaction)
- b. Apply tack coat for all edges and existing surface asphalt (see standard detail)
- c. Install 1.5 times the thickness of existing pavement or a minimum of 6" BM-2 (base mix) flush with existing pavement
- d. Surface treat a minimum of 10' on both sides of trench with blotted seal coat type C: The initial seal and final seal shall conform to the requirements of AASHTO M208 @ .17 gal./sq.yd. With 15 lbs. Of No. 8P stone per sq. yd. each.

3. **Surface Treated Road (Tar and Gravel)**

- a. Backfill entirely with #21-A or #21-B stone (95% compaction)
- b. Apply tack coat for all edges and existing surface asphalt (see standard detail)
- c. Install 4" of BM-2 (base mix) in trench flush with existing pavement
- d. Surface treat a minimum of 10' on both sides of trench with blotted seal coat type C: The initial seal and final seal shall conform to the requirements of AASHTO M208 @ .17 gal./sq.yd. with 15 lbs. Of No. 8P stone per sq. yd. each.

4. **Dirt/Gravel Road or Aggregate Shoulders**

- a. Select backfill compacted to 95% maximum density (6" lifts)
- b. Backfill trench with 10" of #21-A or #21-B stone (95% compaction)
- c. Apply fresh application of #21-A or #21-B stone to all disturbed areas of the road

E. The pavement cut shall be covered with a temporary or permanent asphalt patch on the same day that excavation is made.

F. One travel lane will be maintained at all times.

**Where the Contractor is granted approval to open cut the road for parallel installation within the pavement and service crossings, pavement replacement shall be in accordance with the [PAV Details](#) as reflected in Part II of this document and VDOT permit.**

Placement of all plant mix and surface treated courses shall be rolled where possible with a unit having a manufacturer's rating of 10 tons, and rolled until the aggregate is keyed into the bitumen. Where rolling is not possible, a mechanical tamp will be used. The stone is to be placed in the trench daily up to 1,500 feet at which time the pavement shall be covered with a temporary or permanent asphalt patch. If the application of the bituminous layer is delayed for adverse weather conditions, the contractor shall provide and maintain a base course that is acceptable to both the Virginia Department of Transportation and the Utilities Department of Chesterfield County until such time as the appropriate pavement patch can be applied and accepted.

Upon completion of the installation of the water and sewer lines (not necessarily all testing completed), contractor shall restore pavement in the manner prescribed on the Virginia Department of Highways and Transportation permit within ten (10) days. All trenches and repaving shall be maintained in accordance with the VDOT permit and shall be repaired upon request of VDOT.

**SITE MAINTENANCE AND RESTORATION:** Road connections and private entrances are to be kept in a satisfactory condition. Entrances are not to be blocked and sufficient provisions made for safe travel to adjacent property at all times. When entrances are disturbed, they must be restored to original condition or to a condition satisfactory to the VDOT's Resident Engineer or property owner. Road drainage is not to be blocked. The pavement, shoulders, ditches, general roadside and drainage facilities shall be left in as good condition as found (consistent with adjoining sections of the highway), maintained in a satisfactory condition and establish positive drainage in the ditches. All loose material shall be swept from hard surface immediately after backfilling. Calcium Chloride before sweeping or approved alternate shall be used to settle dust whenever necessary. Concrete walks and curbs shall be replaced in entire sections. During rainy periods all trenches shall be watched closely for settlement. If emergency situation arises under any circumstances, repairs will be made at the Contractor's expense. The contractor shall maintain all trenches and damaged pavement in a manner acceptable to VDOT's Resident Engineer. Additionally, after paving is complete, the contractor shall be responsible for any settlement of trenches requiring additional fill, pavement or other corrective measures until the permit or road is accepted (this includes future State roads currently developer owned). Upon completion of the work under permit, the contractor will notify the Resident Engineer so an inspection can be made to insure compliance with the highway permit, and accepted by VDOT. Where landscaped areas are disturbed, the area shall be left with a minimum of 2" or better of topsoil and reseeded according to VDOT Specifications, this shall include reseeding until a stand of grass is obtained.

**WORK ZONE PROTECTION:** The contractor shall immediately correct any situation which may arise as a result of construction that VDOT or County deem hazardous to the traveling public, even though it may not be specifically covered in the highway permit or other requirements. In the event that these conditions are not complied with, and after reasonable notice has been given by VDOT, it is hereby agreed and understood that VDOT reserves the right to employ an outside Contractor to perform the necessary work and bill the firm doing the work. The word "firm" used in the previous sentence means the individual, corporation, or partnership in whose name the permit was issued.

Traffic is not to be blocked, rerouted or otherwise impeded without written permission from the Resident Engineer. Placement and type of traffic control, warning devices and personnel shall be in accordance with VDOT "Work Area Protection Manual". Where one way traffic is permitted, contractor shall perform proper flagging for the duration of the project. The contractor will notify VDOT at least 24 hours before starting work. If traffic is impeded in any way, the same notice must be given to Fire Department, Rescue Squad, VDOT, Police Department and School Board. All open trenches, pits, etc. shall be secured with barricades and any other necessary equipment to protect the public. The State of Virginia and Chesterfield County shall not be liable for any damage resulting from construction.

### **3.09 DISPOSAL OF WASTE MATERIALS**

- A. Removal From Project Site: Remove waste materials, including unacceptable excavated material, trash, and debris, and dispose of it legally off the project site.
- B. Dust Control: Water, calcium chloride or approved alternate shall be periodically sprinkled to alleviate problems associated with dust.
- C. Disposal of asbestos cement pipe shall be done in accordance with AWWA Manual 16, "Work Practices for Asbestos Cement Pipe".

End of Section

## SECTION 2

### SANITARY SEWER SYSTEM

#### I - GENERAL

##### 1.01 REQUIREMENTS OF REGULATORY AGENCIES

Construction as shown on the plans or stated herein shall be performed in accordance with current and applicable requirements as established by the County of Chesterfield and the Virginia Department of Health or any other agencies having jurisdiction. Where conflicts arise between the Contract Documents and previously mentioned requirements, the more restrictive shall apply. If such requirements require a change in the work as stated herein or shown on the plans, the Contractor shall stop work and notify the County for further direction.

#### II - PRODUCTS

##### 2.01 APPROVED MATERIALS

All materials shall conform to the County of Chesterfield "[Approved Materials and Manufacturers](#)" list. All materials shall be virgin material. The Contractor shall submit a notarized statement from the Supplier and/or Manufacturer to the Inspection Section that all materials being supplied for the work meet AWWA, ASTM and/or County standards, as appropriate. At least three (3) copies for the County's use along with any additional copies needed to be returned to Contractor, Engineer, Suppliers, etc. after approval is made.

In addition, [shop drawings](#), as defined in the General Section, and operation manuals are required [on projects where there are special structures, and on Pump Station, Tank, Pressure Reducing Vault, and Treatment Plant projects to include pipe and accessories, manholes and appurtenances, valves, and other assorted products, etc.] to be submitted by the Utilities Contractor to the Engineering Supervisor in charge of the Inspection Group for approval. The information needs to be sent as far in advance as possible (at least 48 hours) to avoid any unnecessary delays in beginning the project. The appropriate number of copies of shop drawings needed is as defined in the above paragraph.

The certification and/or shop drawings must include manufacturer's name, type of product, location of plant, project name and number, etc. for each product.

##### 2.02 PIPE BEDDING

Bedding material to be crushed stone #57 gradation in accordance with VDOT Road and Bridge Specifications, latest edition.



### III - EXECUTION

#### 3.01 INSTALLATION OF NEW SANITARY SEWER SYSTEMS

##### A. Excavating and Backfilling:

1. Contractor shall do all excavating of any and all materials encountered in the course of excavating for all underground utility systems. After the pipe is in place, backfill with suitable material, free from frozen earth, rocks, organic materials, etc.
  - a. Provide all necessary shoring required for the protection of excavations, existing utilities and workmen and do all necessary pumping required to keep excavation and pipe free from water from any source at all times.
  - b. Provide sufficient barricades, etc., adjacent to excavations to safeguard against injury to workmen and the public. Provide and maintain sufficient warning lanterns at walks, roadways, and parking areas to provide safety at all times.
  - c. Where roots of live trees are encountered in excavations, they shall be carefully protected during construction.
  - d. Exercise special care in backfilling trenches to guard against disturbing the joints.
  - e. Remove and dispose of any material not used for backfill.
2. Removal of subsurface obstructions which are uncovered during excavation for installation of the sanitary sewer systems shall be by the Contractor at his expense. This shall include removal of existing concrete or brick of existing building foundations, footings, abandoned utility piping, wires, structures, rock boulders, etc., which may not be visible from surface investigations before construction, but will interfere with new installations. If such obstructions are encountered, they shall be removed two feet from around the area of new work and the excavation backfilled with a suitable material as specified.

##### B. Pipe Handling:

1. Take all precautions to insure that pipe and related items are not damaged in unloading, handling and placing in trench. Examine each piece of material just prior to installation to determine that no damage has occurred. Remove any damaged material from the site and replace with undamaged material.

2. Keep pipe clean. Exercise care to keep foreign material and dirt from entering pipe during storage, handling and placing in trench. Flushing line may be necessary by the Contractor.
3. Survey Line and Grade:
  - a. Line and grade shall be maintained by the Contractor by the use of a laser and Contractor shall adhere to the following criteria:
    - 1) Control point shall be set at a minimum of fifty foot (50') interval. Line and grade of the laser shall be checked at a maximum of one hundred foot (100') intervals.
    - 2) Standard cut sheet shall be provided to the County showing center line cut each twenty-five feet (25') where payment for installation is on a cut increment basis and hub cut at each fifty foot (50') station.
    - 3) The level vial on the grade instrument of the laser shall be checked at a minimum of each 30 minutes of use or more frequent if equipment is being used around the grade instrument that could cause the instrument to become unlevel.
    - 4) A blower shall be used when required to keep a uniform air temperature in the pipe to prevent any bending of the light beam.
  - b. Contractor shall have level or transit in good working order on the job set up at all times to periodically check line and grade of pipe.
4. Sewer Pipe Laying:
  - a. Laying of sewer pipe shall be accomplished to line and grade in the trench only after it has been dewatered and the foundation and/or bedding has been prepared. Mud, silt, gravel, and other foreign material shall be kept out of the pipe and off the jointing surfaces.
  - b. All pipe laid shall be retained in position so as to maintain alignment and joint closure until sufficient backfill has been completed to adequately hold the pipe in place. All pipe shall be laid to conform to the prescribed line and grade shown on the drawings. After completion the pipe shall exhibit a full circle of light at one manhole when viewed from the next.

- c. The sewer pipe, unless otherwise approved by the County, shall be laid upgrade from point of connection of the existing sewer or from a designated starting point. If the starting point is at an existing stub, it shall be removed and a full length of pipe installed. The sewer pipe shall be installed with the bell end forward or upgrade. When pipe laying is not in progress the forward end of the pipe shall be kept tightly closed with a water tight plug or cap.
- d. The pipe shall be fitted and matched so that when installed it will form a smooth, uniform invert. Lined or radius concrete pipe shall be placed as indicated by the marking on the pipe.
- e. Prior to joining the pipe, all surfaces of the pipe to be joined and the surfaces of factory made jointing materials shall be clean and dry. Lubricants, primers, adhesives, etc., shall be applied and the pipes joined as recommended by the manufacturer's specifications. Sufficient pressure shall be applied in making the joint to assure that the pipe is "home". The interior of the pipe shall be cleaned of all foreign material as the work progresses. At the end of the work day, the last pipe laid shall be blocked to prevent creep, and closed with a water tight plug or cap.
- f. Joining Pipe:
  - 1) Ductile iron pipe to be joined in accordance with the requirements of AWWA Standard C600 and the manufacturer's recommendations.
  - 2) Asbestos-cement pipe shall be jointed in accordance with manufacturer's recommendations.
  - 3) Polyvinyl chloride (PVC) pipe shall be joined in accordance with ASTM Standard D-2321.
- g. All visible leaks shall be corrected prior to testing.
- h. PVC pipe shall be provided with anti-flotation ballast where cover is less than 3'.

C. Manhole Installation:

- 1. Manholes shall be constructed to the elevations indicated in accordance with the [Standard Details](#).

- a. Set manhole base section on bed of #57 stone to a minimum depth of 8 in. Stone shall be thoroughly compacted and carefully leveled to the excavated wall.
- b. Join all manhole risers, cone top sections, and any other sections by the use of rubber gaskets.
- c. Install pipe stubs in manholes where called for on the plans. All stubs shall extend beyond the manhole as reflected on the plans and shall be sealed with a watertight plug or cap.
- d. Install flexible manhole connections for all pipes sizes 6 in. to 21 in., inclusive and apply sealant to completely fill joint between manhole barrel and flexible connection for the full thickness of the manhole barrel.
- e. Plug lift holes from the outside with nonshrink grout and repair any defects in manhole.
- f. Set adjusting rings in Portland cement mortar bed (minimum of 1/4" thickness and parge 1/8" to 1/4" thickness on inside and outside of manhole).
- g. Rings will not be required outside of paved roadways or walkways unless called for on the plans.
- h. Rings in paved roadways or walkways shall permit upward or downward adjustment of manhole frame. Maximum height of rings shall not exceed 12", otherwise, the cone section will require removal and a new manhole riser installed to allow for the upward and downward adjustment as stated above.
- i. Construct bench of concrete or brick and mortar.
  - 1) Elevation of bench at the channel shall be at the spring line of the incoming and outgoing pipe.
  - 2) Bench shall be three inches lower at channel than at manhole wall.
  - 3) Where B.U.O. or stubs are provided for future pipe connections, bench and invert shall be so formed.
  - 4) Use sulfate resistant cement for concrete or mortar on all acid-resistant manholes.

5) Where sealant is used, bench shall not be in contact with pipe or flexible pipe connection.

6) All inverts to be smooth.

j. All leaks shall be corrected prior to testing.

D. Service Connections: Place a tee fitting with 6-inch outlet in the sewer where service connection is to be constructed. Lay 6 inch PVC or ductile iron pipe from the tee to the property line or easement limits on a grade of not less than 1/4 in. per foot unless otherwise shown on plans. Where connections are laid out of manholes, contractor shall use a laser beam. Close service connection at the property line with an approved watertight plug, and mark the end with 2" x 4" board installed plumb from bottom of 6" plug to 2' above ground. Service connection shall be of same type of pipe as sewer unless otherwise approved by County. When making a service connection to an existing sewer, the Contractor shall use a mechanical hole cutter and approved saddle.

E. Existing Manhole Tie-In: Core drilling and a flexible pipe-to-manhole connector shall be used in the connection of the sewer pipe to precast manholes, where stubs or bricked up opening (B.U.O.) do not exist.

The connector shall be Kor-N-Seal assembly or approved equal.

The connector shall be installed in the manhole wall by activating the expanding mechanism in strict accordance with the recommendation of the connector manufacturer.

The connector shall be of a size specifically designed for the pipe material and size being utilized on the project. All materials must conform to the approved products reflected in Part V of this document.

Where bricked up openings (B.U.O.) exist, a PVC manhole adaptor shall be used in the connection of the sewer pipe to precast manholes and installed using the proper conventional methods such as the process established for the "GPK PVC Manhole Adaptors" or equal.

### **3.02 TESTING OF NEW SANITARY SEWER SYSTEM**

A. Testing Technique for Sanitary Sewer System:

1. Sanitary sewer lines 42 inches in diameter and smaller shall be tested after backfill using a low-pressure air test in accordance with ASTM C828-90 or latest edition. Sewer lines larger than 42 inches in diameter shall be tested by infiltration/exfiltration test.

All manholes shall be vacuum tested. All testing shall be conducted in the presence of the Owner or Owner's representative. All labor, materials, tools, and equipment necessary to make the tests shall be provided by the Contractor. All equipment and methods used shall be acceptable to the Owner. All monitoring gauges shall be subject to calibration, if deemed necessary.

2. Low Pressure Air Test:

- a. Summary of Method: Plug the section of the sewer line to be tested. Introduce low-pressure air into the plugged line. Use the quantity and rate of air loss to determine the acceptability of the section being tested.
- b. Preparation of the Sewer Line: If required by Owner, flush and clean the sewer line prior to testing and cleaning out any debris. Plug all pipe outlets using approved pneumatic plugs with a sealing length equal to or greater than the diameter of the line being tested. Give special attention to laterals.
- c. Ground Water Determination: Install a ½ inch capped galvanized pipe nipple, approximately 12 inches long, through the manhole on top of the lowest sewer line in the manhole. Immediately prior to the line acceptance test, the ground water elevation shall be determined by removing the pipe cap and blowing air through the pipe nipple into the ground so as to clear it, and then connecting a clear plastic hose to the pipe nipple. The hose shall be held vertically and a measurement of the height in feet of water over the invert of the pipe shall be taken after the water has stopped rising in the plastic hose.
- d. Procedures: Determine the test duration for the section under test by computation from the applicable formulas shown in ASTM C828-90 or latest edition. The pressure-holding time is based on an average holding pressure of 3 psi gage or a drop from 3.5 psi to 2.5 psi gage.

Add air until the internal air pressure of the sewer line is raised to approximately 4.0 psi gage. After an internal pressure of approximately 4.0 psig is obtained, allow time for the air pressure to stabilize. The pressure will normally show some drop until the temperature of the air in the test section stabilizes.

When the pressure has stabilized and is at or above the starting test pressure of 3.5 psi gage, commence the test. Before starting the test, the pressure may be allowed to drop to 3.5 psig. Record the drop in pressure for the test period. If the pressure has dropped more than 1.0 psi gage during the test period, the line shall be presumed to have failed. The test may be discontinued when the prescribed test time has been completed even though the 1.0 psig drop has not occurred.

The test procedure may be used as a presumptive test which enables the installer to determine the acceptability of the line prior to backfill and subsequent construction activities.

If the pipe to be tested is submerged in ground water, the test pressure shall be increased by 1.0 psi for every 2.31 feet the ground water level is above the invert of the sewer.

- e. Safety: The air test may be dangerous if, because of lack of understanding or carelessness, a line is improperly prepared.

It is extremely important that the various plugs be installed and braced in such a way as to prevent blowouts. Inasmuch as a force of 250 lb. is exerted on an 8 inch plug by an internal pipe pressure of 5 psi, it should be realized that sudden expulsion of a poorly installed plug or of a plug that is partially deflated before the pipe pressure is released can be dangerous.

As a safety precaution, pressurized equipment shall include a regulator or relief valve set at no more than 10 psi to avoid over-pressurizing and damaging an otherwise acceptable line. No one shall be allowed in the manholes during testing.

- 3. All manholes will be tested using the negative air pressure test (vacuum) in accordance with ASTM C 1244-93 or latest edition for watertightness, and manhole will be visually inspected after backfilling. Contractor may backfill before testing with the understanding that any repairs will be made from the exterior of the manhole.

Manholes shall be vacuum tested and shall have 10-inches of mercury applied to the manhole and the time measured for the vacuum to drop from 10-inches to 9-inches of mercury. Vacuum equipment shall be approved by the local agency and/or Engineer prior to its use. See detail #SEW-10 for minimum allowable test times for manhole acceptance at the specified vacuum drop.

Test times for structures other than manholes will be based on the times for manholes of the nearest equivalent volume or as directed by the Engineer.

Written verification must be furnished that the following steps are followed:

- a. The test method is only to be applied to precast concrete manholes.
  - b. Stubouts, manhole boots and pipe plugs shall be secured to prevent movement while the vacuum is drawn.
  - c. If a manhole fails the test, necessary repairs shall be made and the vacuum test and repairs shall be repeated until the manhole passes the test.
4. Test for leakage of gravity sewers using either the infiltration or exfiltration test:
- a. Allowable leakage shall be 50 gallons per inch of pipe diameter per mile per 24 hours up to a maximum of 2,400 gallons per mile per 24 hours for gravity sewers greater than 42" in diameter.
  - b. Use infiltration test when ground water is at least 4 feet above pipe crown along entire length of line to be tested. Plug the pipe at the upper manhole. Install suitable measuring device at the next lowest manhole. Measure the amount of water flowing through the outlet after flow has been stabilized.
  - c. Ground Water Determination: Use same procedure as "low pressure air test" above.

B. Testing Requirements for Sewer Force Mains:

1. All pressure testing shall conform to the requirements as established for Water Distribution Systems as outlined in Part IV Section 3 of this document.



### **3.03     MARKERS**

In easements and in undeveloped wooded areas, plastic markers shall be installed every 200 feet, and at all manholes, valves, and fittings. Markers shall be as manufactured by Carsonite, Greenline, or approved equal. Exceptions are where sanitary gravity and force main lines are installed in "kept" yards where the property owners may object to the placement of these markers. Contractors will be required to properly install the markers per manufacturer's recommendations, parallel to the sewer line facing roadway, or as additionally directed by the local agency.

### **3.04     CLEAN-UP**

Upon the completion of the installation of the sanitary sewer system and prior to the Owner's final acceptance, sediment and debris shall be removed from the system. The work area shall be restored to its original condition and pavement replaced to the satisfaction of VDOT and/or County.

End of Section

## SECTION 3

### WATER DISTRIBUTION SYSTEM

#### I - GENERAL

##### 1.01 REQUIREMENTS OF REGULATORY AGENCIES

Construction as shown on the plans or stated herein shall be performed in accordance with current and applicable requirements as established by the County of Chesterfield and the Virginia Department of Health or any other agencies having jurisdiction. Where conflicts arise between the construction documents and previously mentioned requirements, the more restrictive shall apply. If such requirements require a change in the work as stated herein or shown on the plans, the Contractor shall stop work and notify the County for further direction.

#### II - PRODUCTS

##### 2.01 APPROVED MATERIALS

All materials shall conform to the County of Chesterfield "[Approved Materials and Manufacturers](#)" list. All materials shall be virgin material. The Contractor shall submit a notarized statement from the Supplier and/or Manufacturer to the Inspection Section that all materials being supplied for the work meet AWWA, ASTM and/or County Standards as appropriate. At least three (3) copies for the County's use along with any additional copies needed to be returned to Contractor, Engineer, Suppliers, etc. after approval is made.

In addition, shop drawings, as defined in the General Section, and operation manuals are required [on projects where there are special structures, and on Pump Station, Tank, Pressure Reducing Vault, and Treatment Plant projects to include pipe and accessories, manholes and appurtenances, valves, and other assorted products, etc.] to be submitted by the Utilities Contractor to the Principal Utilities Engineer in charge of the Inspection Group for approval. The information needs to be sent as far in advance as possible (at least 48 hours) to avoid any unnecessary delays in beginning the project. The appropriate number of copies of shop drawings needed is as defined in the above paragraph.

The certification and/or shop drawings must include manufacturer's name, type of product, location of plant, project name and number, etc. for each product.

#### III - EXECUTION

##### 3.01 INSTALLATION OF NEW WATER SYSTEMS

###### A. Excavating and Backfilling:

1. Contractor shall do all excavating of any and all materials encountered in the course of excavating for all underground utility systems. After the pipe is in place, backfill with suitable earth, free from rocks, organic material, etc.

- a. Provide all necessary shoring required for the protection of excavations, existing utilities and workmen and do all necessary pumping required to keep excavation and pipe free of water from any source at all times.
  - b. Provide sufficient barricades, etc., adjacent to excavations to safeguard against injury to workmen and the public. Provide and maintain sufficient warning lanterns at walks, roadways, and parking areas to provide safety at all times.
  - c. Where roots of live trees are encountered in excavations, they shall be carefully protected during construction.
  - d. Exercise special care in backfilling trenches to guard against disturbing the joint.
  - e. Remove and dispose of any material not used for backfill.
2. Removal of subsurface obstructions which are uncovered during excavation for installation of the water systems shall be removed by the Contractor at his expense. This shall include removal of existing concrete or brick of existing building foundations, footings, abandoned utility piping, wires, structures, rock boulders, etc., which may not be visible from surface investigations before construction, but will interfere with new installations. If such obstructions are encountered they shall be removed two feet from around the area of new facility and backfilled with a suitable material as specified.

B. Pipe Installation:

1. Take all precautions to insure that pipe and related items are not damaged in unloading, handling and placing in trench. Examine each piece of material just prior to installation to determine that no damage has occurred. Remove any damaged material from the site and replace with undamaged materials.
2. Keep pipe clean. Exercise care to keep foreign material and dirt from entering pipe during storage, handling and placing in trench. Contractor shall be responsible for plugging or capping line at the end of each day.
3. Do not lay pipe when weather or trench conditions are unsuitable.

4. Line and grade hubs shall be set by a registered surveyor at intervals to accurately insure proper location of water line and appurtenances. This shall include finished grade centerline stakes for fire hydrants, stakes at all fittings referencing all property pins, etc. Cut sheets are required where the water line is to be laid to a grade according to the profiles in the plans, or where the future road grade is not yet to within 6" of its final location.
5. Water Pipe Laying:
  - a. Laying of water pipe shall be accomplished only after the trench has been dewatered and the foundation and/or bedding has been prepared. Mud, silt, gravel, and other foreign material shall be kept out of the pipe and off the jointing surfaces.
  - b. All pipe laid shall be retained in position so as to maintain alignment and joint closure until sufficient backfill has been completed to adequately hold the pipe in place. All pipe shall be laid to conform to the prescribed line and grade shown on the plans and shall include digging out for bell ends.
  - c. Water pipe runs intended to be laid straight shall be so laid. Deflection from a straight line may be made by deflecting the joints only when permission has been given by the County. Joint deflection in pipe shall not exceed one-half that recommended by AWWA Standards or the manufacturer whichever is less. Changes in grade or alignment which cannot be made by deflecting pipe joints shall be made by use of proper bends, offsets or special fittings as required.
  - d. The water pipe, unless otherwise approved by the Inspector, shall be laid up grade from point of connection of the existing water line or from a designated starting point. Water pipe shall be installed with the bell end forward or upgrade. When pipe laying is not in progress, the forward end of the pipe shall be kept tightly closed with a water tight plug or cap, plywood or plastic is not acceptable.
  - e. The pipe shall be fitted and matched so that when laid in the work, units will form a smooth, uniform invert.

- f. Prior to joining the pipe, all surfaces of the pipe to be joined and the surfaces of factory made jointing materials shall be clean and dry. Approved lubricants, primers, adhesives, etc., shall be applied and the pipes joined as recommended by the manufacturer's specifications. Sufficient pressure shall be applied in making the joint to assure that the pipe is "home".

The interior of the pipe shall be cleaned of all foreign material as the work progresses. At the end of the work day, the last pipe laid shall be blocked to prevent creep, and closed with a water tight plug or cap.

g. Joining Pipe:

- 1) Ductile iron pipe to be joined as follows:

(a) Mechanical point pipe

- (1) When installing PVC pipe into M.J. fittings, the beveled end of the pipe must be cut off to allow for maximum insertion depth and sealing area to avoid leaks. Thoroughly clean inside of the bell and 8 inches of the outside of the spigot end of the joining pipe to remove oil, grit, excess coating and other foreign matter from the joint. Paint the bell and spigot with soap solution (half cup granulated soap dissolved in 1 gallon water). Slip cast-iron gland on spigot end with lip extension of gland toward end of pipe. Paint rubber gasket with or dip into the soap solution and place on the spigot end with thick edge toward the gland.

- (2) Push the spigot end forward to seat in the bell. Then carefully press the gasket into the bell so that it is located evenly around the joint. The gland is moved into position, bolts inserted and nuts screwed up finger tight, then tighten all nuts to torque listed below.

Bolts Size Inches	Torque-Ft. Lbs.
?	40 - 60
$\frac{3}{4}$	60 - 90
1	70 - 100
1 1/4	90- 120

- (3) Tighten nuts on alternate sides of the gland until pressure on the gland is equally distributed, and torque value is reached.
- (4) Permissible deflection in mechanical joint pipe shall not be greater than one-half of that listed in AWWA C600.

(b) Push-on point Ductile Iron pipe

- (1) Thoroughly clean inside of the bell and 8 inches of the outside of the spigot end of the joining pipe to remove oil, grit, excess coating, and other foreign matter. Flex rubber gasket and insert in the gasket recess of the bell socket. Apply a thin film of gasket lubricant (Blue Lube or Slikstyx), to the gasket and spigot end of the joining pipe. (Note: Use of any unapproved lubricant other than Blue Lube or Slikstyx has been shown to cause significant taste and odor conditions when used in drinking water disinfected with chloramines. The County will not accept completed water lines that exhibit taste and odor conditions as a result of the use of unapproved lubricants.)
- (2) Start spigot end of pipe into socket with care. The joint shall then be completed by forcing the plain end to the bottom of the socket with a forked tool or jack type device. Field cut pipe shall have the end filed to match the manufactured spigot end.
- (3) Permissible deflection in push-on joint pipe shall not be greater than one-half of that listed in AWWA C600.

- 2) Polyvinyl chloride (PVC) pipe shall be joined in accordance with the manufacturer's recommendations.

Polyvinyl Chloride (PVC) Push-on Joint Pipe

- a) Thoroughly clean inside of the bell and 1" beyond the reference mark on the spigot end of the joining pipe. Make certain the bell and rubber gasket have no foreign material that could interfere with the proper assembly of the pipe spigot.
  - b) Lubricate the gasket and spigot end of the pipe, using only approved lubricant (Blue Lube or Slikstyx). (Note: Use of any unapproved lubricant other than Blue Lube or Slikstyx has been shown to cause significant taste and odor conditions when used in drinking water disinfected with chloramines. The County will not accept completed water lines that exhibit taste and odor conditions as a result of the use of unapproved lubricants.)
  - c) Insert the spigot end into the bell. Align the pipe sections and push the spigot end in until the reference mark on the spigot end is flush with the end of the bell. Use a bar and block of wood to push pipe home.
  - d) Field cut pipe shall be square cut and beveled to insure proper assembly. Use a factory finished beveled end as a guide to produce an equivalent angle and length of taper.
- 3) Asbestos Cement Transition:
- a) When connecting PVC or Ductile Iron pipe to existing asbestos cement pipe, the transition coupling is to be applied to the rough barrel of the asbestos cement pipe and not to a factory or machined end of the asbestos cement pipe.
- h. A tracing wire of 14 gauge copper shall be installed and taped directly on top of the pipe in a manner that a continuous trace results. Wire is to be wrapped around hydrants, blow offs and corporation stops.

- i. Place underground warning tape directly above all water mains, 18" below finished grade. Tape shall be polyethylene tape with a metallic core, 2 inches in width, with the continuous printed message "Caution Waterline Buried Below." Tape shall be Catalog No. 2 WAT as manufactured by the Seton Name Plate Corp. or approved equal.

C. Installation of Valves, Fittings, and Hydrants:

1. General: Valves, fittings and hydrants shall be set and jointed to the piping system as hereinbefore specified for cleaning, laying and jointing pipe.
2. Valves and Valve Boxes: Cast iron valve boxes shall be firmly supported, centered and plumb over the operating unit of valve. Box cover shall be set flush with the surface of finished pavement or at such other level as may be directed by the Inspector. Valve rod extension with guide shall be required to maintain a distance of 2'-4' from operating nut to top of box. All valves shall be properly restrained.
3. Cross Connections: Drainage branches or blow-offs shall not be connected to any sewer, submerged in any stream or installed in any manner which, in the opinion of the Inspector, will constitute a contamination hazard or cross connection.
4. Hydrants:

Connection to Main: Each hydrant shall be restrained and connected to the main with a minimum 6 inch branch, controlled by an independent 6 inch gate or resilient seat valve.

Setting of Hydrants: When hydrants are set, a drainage pit two feet in diameter and two feet below the bowl of the hydrant shall be excavated. Valves: All valves shall be restrained with a hydrant tee.

The pit shall be filled with coarse gravel or #57 clean stone, mixed with coarse sand, to a level of 6 inches above the weephole. No hydrant drainage pit shall be connected to a sewer. The bowls of all hydrants shall be well braced against unexcavated earth with suitable concrete backing, and when directed shall be restrained to the pipe with approved harnessing. All hydrants shall be thoroughly cleaned of dirt or foreign matter before setting.

5. Anchorage of Fittings: As required in [Part V, Section 4](#) of this document, all fittings, i.e., each bend, tee, plug, valve and cap shall be prevented from moving by means of adequate thrust reaction blocking or mechanical restraints; or both.



6. In easements and in undeveloped wooded areas, plastic markers shall be installed every 200 feet, and at all valves and fittings. Markers shall be as manufactured by Carsonite or approved equal. Exceptions are where water lines are installed in "kept" yards where the property owners may object to the placement of these markers. Contractors will be required to properly install the markers per manufacturer's recommendations, parallel to the water line facing roadway, or as additionally directed by the County.

D. Installation of Fabricated Steel Tapping Sleeves:

1. General: Rigorous testing and conditions relating to tapping sleeves, applied to all manufacturers, is standard operating procedure. These conditions are as follows:
  - a. The tapping sleeve shall be tested in place to a minimum of 200 psi, for a minimum of 10 minutes with no loss of pressure.
  - b. If the sleeve fails the 200 psi pressure test, the original failed sleeve shall be replaced with an entirely new sleeve.
  - c. Tapping sleeves 16" and above shall be supported by a concrete pedestal support, as shown in the County's "Standard Details" Section.
2. Rockwell Tapping Sleeve: In addition to the conditions outlined in Section 1 above, the following procedures must be followed by the contractor:
  - a. Clean pipe surface thoroughly, particularly in the area where the gasket will seal. The contractor shall wipe the pipe in the area where the tap is to be made with a 1% chlorine solution prior to installing the sleeve.
  - b. Lubricate pipe and gasket with soap and water.

It is not necessary to lubricate pipe. (See item c. Under no condition should any antifreeze be used.)
  - c. Mount body halves on pipe. Contractor shall ensure gasket is secure in gasket groove.

Contractor shall ensure that the tapping nipple is pointing in its final direction so it will not be moved or rotated on the pipe. This half of the sleeve can be blocked in some fashion so the back half of the sleeve and bolts can be installed without having to have several people involved in attaching the sleeve.

- d. Insert bolts and hand tighten nuts, keeping equal gaps between body halves.
- e. Prior to tightening nuts, position outlet as required to suit the installation. Contractor shall ensure test connection is accessible.
- f. Tighten bolts, alternating from one side to the other to equalize the gap between halves. Continue to tighten bolts until sleeve halves conform to the contour of the pipe and all bolts are to a uniform tightness. The required torque for dry threads will be 70-100 ft. lbs. (Lubricated threads 35-50 ft. lbs.) On thin wall or badly corroded pipe care should be taken to prevent crushing or collapsing of the pipe.
- g. A pressure test is required prior to tapping to test the sleeve and valve in place.

Prior to pressure testing, the inspector shall obtain a reading of line pressure in the system, either from a hydrant or a service. The pressure test should be at  $2\frac{1}{2}$  times line pressure or 200 psi, whichever is greater. The duration of this pressure test shall be a minimum of ten minutes. If the sleeve fails the pressure test it shall be completely removed and returned and a new sleeve used. The tapping sleeve, valve and tapping machine assembly is to be adequately supported during the tapping operation to prevent movement or rotation of the tapping sleeve.

- h. Proceed with tapping operation.

Contractor shall complete tapping procedure and perform the necessary checking as required. Contractor shall furnish the inspector with the coupon.

- i. Check the bolts for tightness and retorque if required.

E. Installation of Services

1. 3/4" and 1"

- a. Taps on PVC Pipe shall be made with service saddles ([from approved list](#))
- b. Taps shall be made on a 45° angle
- c. Corporation stops shall have "cc" thread inlet and copper flare outlet
- d. Tap shall be made with a tapping machine equipped with a bit designed for the type of pipe being tapped
- e. Distance between taps or from a joint or bell shall be a minimum of 18"
- f. Service pipe shall be type "K" soft copper
- g. Services shall be installed with 3'6" minimum cover up to meter yoke where yoke shall be installed so that meter will set 12"-16" from finished grade
- h. Meter yokes shall be from approved materials list and be installed with a tail piece of type "K" copper 10"-18" long
- i. Meter yoke and box shall be set 1' inside property line or a reasonable distance inside property line in order to install on reasonable level ground
- j. Backfill shall be hand tamped up to service pipe at tap to prevent corporation stop from being broken off during backfilling
- k. Traffic box to be of cast iron in driveways

2. 1½" and 2" Services

- a. All taps for 1½" and 2" services shall be made with service saddles ([from approved materials list](#))
- b. Taps shall be made at the spring line of the pipe
- c. Corporation stops shall have "cc" thread inlet and copper flare outlet
- d. Tap shall be made with a tapping machine equipped with a bit designed for the type of pipe being tapped

- e. Distance between taps or from a joint or bell shall be a minimum of 18"
- f. Service pipe shall be type "K" hard copper
- g. Services shall be installed with 3'6" minimum cover up to meter yoke where yoke shall be installed so that meter will set 12"-16" from finished grade
- h. Meter yokes shall be from approved materials list and be installed with a tail piece of type "K" copper 10"-18" long
- i. Meter yoke and box shall be set 1' inside property line or a reasonable distance inside property line in order to install on reasonably level ground
- j. On 1½" and 2" services a curb stop shall be installed on inlet side of yoke, 1' from yoke
- k. Backfill shall be hand tamped up to service pipe at tap to prevent corporation stop from being broken off during backfilling

### 3.02 TESTING OF WATER DISTRIBUTION SYSTEM

#### A. Testing Techniques for Water Distribution System:

1. Each properly isolated section of the piping system including all water services shall be subjected to a pressure test of 150 psi, or 1-1/2 times the working pressure whichever is greater, measured at the high point of the system. Maintain this pressure for a minimum of two hours with an allowable leakage as reflected in the [Standard Details Section -Part II](#). Prior to applying pressure to the lines all reaction blocking, and/or mechanical restraints shall have been completed to the satisfaction of the Inspector. As the pipes are being filled, all air shall be expelled from the pipes by providing suitable taps at the high points of the system. After the system is filled, all taps shall be tightly plugged.

Any defects discovered during this test shall be repeated until the results are satisfactory to the Inspector. The Contractor shall provide all equipment and materials and perform all labor necessary to conduct the test. The Contractor shall provide a suitable test pump and properly calibrated gauge or other means for measuring leakage to include, a clean 50 gallon barrel with top cut out, etc., which is satisfactory to the Inspector.

2. The County will furnish the water used for flushing, sterilization and testing without charge. Filling of water line may be performed provided permission has been obtained from the Inspector who will be responsible for coordinating this activity with the County's Operations and Maintenance Section. Contractor is not permitted to operate valves on existing lines.
3. Testing shall be performed in accordance with the AWWA Specifications, latest revision.

### 3.03 DISINFECTION

A. Prior to being placed in service, the pipe line and appurtenances shall be disinfected in general accordance with ANSI/AWWA C651- 92; AWWA Standard for **Disinfecting Water Mains** and the supplemental procedures as set forth below.

1. Section 3 of AWWA C651-92 emphasizes six basic procedures in the disinfection process. The procedures are to:
  - a. prevent contaminating materials from entering the water main during storage, construction, or repair;
  - b. remove, by flushing or other means, those materials that may have entered the water main;
  - c. chlorinate any residual contamination that may remain, and flush the chlorinated water from the main;
  - d. protect the existing distribution system from backflow due to hydrostatic pressure test and disinfection procedures;
  - e. determine the bacteriological quality by laboratory test after disinfection; and
  - f. make final connection of the approved new water main to the active distribution system.

#### 2. Preliminary Flushing:

The main shall be flushed prior to disinfection at a velocity of not less than 2.5 Ft./Sec. unless the owner determines that conditions will not permit the required flow. See [Table 1, entitled "Flushing Schedule"](#). Adequate provisions shall be made by the contractor for disposal of flushing water so that no physical or environmental damage results. Contractor will find additional instructions on flushing in the supplemental procedures within this section.

3. Forms of Chlorine for Disinfection:

It is the contractor's responsibility to be familiar with and have available for his employees the "Product Data Safety Sheets" of any products used as a source of chlorine and to provide the proper safety instructions and personal protective equipment to the employees mixing and using materials for disinfection of the water facilities.

- a. Acceptable sources of chlorine for disinfection may be obtained from any of the following three sources:
  - 1) Liquid sodium hypochlorite (household bleach)
  - 2) Liquid sodium hypochlorite (industrial strength)
  - 3) Calcium hypochlorite granules
- b. Only under extreme conditions and with the written approval of the owner and under the direction of a holder of a State of Virginia Class III (or higher) water works operator's license can chlorine gas, regulated through proper metering equipment, be mixed with water to obtain a suitable disinfecting solution.
- c. The direct introduction of chlorine gas (or liquid) from a pressure cylinder into a water line is not safe and shall not be allowed.
- d. The use of calcium hypochlorite pills affixed to the interior of water pipe for disinfection shall not be an acceptable form of disinfection.
- e. The mixing of a source of chlorine to obtain a suitable disinfecting solution shall be as follows:
  - 1) Liquid sodium hypochlorite is supplied in strengths from 5.25 percent available chlorine (commercially available household bleach) to 15 percent available chlorine (industrial strength sodium hypochlorite). A water-sodium hypochlorite solution shall be prepared by adding liquid sodium hypochlorite to water.

- 2) A water calcium hypochlorite solution shall be prepared by dissolving calcium hypochlorite granules containing 65% available chlorine by weight in a pre-determined volume of water to make the desired water-calcium hypochlorite concentration. Disinfection of new mains by water calcium hypochlorite solution shall not be used unless a suction or in-line strainer is available on the solution pump to prevent any undissolved solids from entering the piping. An alternative method of straining the solution to remove undissolved granules may be approved by the inspector on a case by case basis.
- 3) A water-chlorine gas solution may be used only when suitable equipment is available and shall be done under the direct supervision of a person familiar with the physiological, chemical, and physical properties of this element and who has a State of Virginia Class III or above water works operator's license and is properly trained and equipped to handle any emergency that may arise.
- 4) The direct introduction of chlorine gas (or liquid) from a pressure cylinder into a water line is not safe and shall not be allowed.

#### 4. Method of Chlorine Application and Testing:

- a. The continuous feed method of applying the disinfecting solution shall be as follows: Water from the existing distribution system or other approved sources of potable water supply shall flow through an approved flushing mechanism ([Standard Detail WAT-6](#)) at a constant, measured rate into the newly-laid pipeline. The water shall be mixed with a chlorine-water solution as prepared above, also fed at a constant, measured rate. The two rates shall be proportioned so that the chlorine concentration of the water and water/chlorine solution in the pipe is elevated to and maintained at, a minimum of 50 mg/l available chlorine.

Since the forms of preparation for a water sodium hypochlorite or water calcium hypochlorite concentration are a batch process, a method acceptable to the inspector shall be available to replenish the concentration being fed and mixed with the water flow, so there is no interruption of the flow of disinfection solution.

To assure that this concentration is maintained, the chlorine residual shall be measured at intervals not exceeding 2,000 feet and at the end of all branch lines or cul-de-sacs in accordance with the procedures outlined herein. During the application of the chlorine-water solution, valves, hydrants and any other appurtenances shall be operated in order to be thoroughly disinfected. Chlorine-water solution application shall continue until the entire new main is filled with water having a residual of a minimum of 50 mg/l chlorine solution. The chlorinated water shall be retained in the main for at least 24 hours.

- b. The Owner will furnish the personnel and equipment for determining water-chlorine solution strengths and residuals.
- c. After the applicable retention period, the heavily chlorinated water shall be flushed from the main until the chlorine residual of the water leaving the main is equal to the chlorine residual of the incoming system water. At that time, the new system shall be valued off and bacteriological testing shall begin as indicated in [Section 3.03.B](#). Additional instructions for disposal of the heavily chlorinated water is covered in [Section 3.04.E, entitled "Flushing"](#).

B. Bacteriological Tests:

- 1. After final flushing, and before the water main is placed in service, samples shall be collected and tested for bacteriological quality as follows:
  - a. If total chlorine is 1.5 mg/L or less: Begin bacteriological testing at 24 hours after final flush.
    - 1) Test for total and fecal coliform for 2 consecutive days. Both test samples must be less than 1 colony/100 ml.
    - 2) Test for heterotrophic plate count on 2nd day. Test sample must be less than 500 colonies/ml.



b. If total chlorine is greater than 1.5 mg/l: Wait 5 days or until residual drops to 1.5 mg/l or less, whichever is sooner, then test.

1) Test for total and fecal coliform for 2 consecutive days. Both test samples must be less than 1 colony/100 ml.

2) Test for heterotrophic plate count on 2nd day. Test sample must be less than 500 colonies/ml.

Samples shall be collected at least 24 hours apart at intervals determined by the Inspector (not exceeding 2,000 feet apart and at the end of all branch lines and cul-de-sacs) and tested by the County of Chesterfield laboratory and the results submitted to the Owner.

2. Samples for bacteriological analysis shall be collected in approved sterile bottles or bags treated with sodium thiosulfate provided by the County laboratory. If laboratory results indicate the presence of coliform bacteria, the samples are unsatisfactory and disinfection shall be repeated as prescribed above until the samples are satisfactory. Cleaning, disinfection and testing shall be under the direction of the Inspector but remains the responsibility of the Contractor. Water for these operations will be furnished by the Owner, but the Contractor shall be responsible for any cost associated with the loading, hauling, and discharging of the heavily chlorinated water.

### **3.04 SUPPLEMENTAL PROCEDURES FOR DISINFECTING, TESTING, AND FLUSHING**

#### **A. GENERAL:**

1. All work shall be performed in general accordance with AWWA C651-92.

2. The supplemental procedures are developed to compliment the AWWA C651-92 Standard, particularly with respect to flushing, testing and tie-in to the existing water distribution system.

3. These procedures and construction acceptance for final tie-in of a new water main are performance based, predicated on the new construction passing pressure and bacteriological testing. In order to best assure satisfactory bacteriological results, it is essential that all aforementioned preventive and precautionary measures be taken prior to and during construction to

protect the interiors of pipe, fittings and valves against contamination. Failure to follow the precautionary measures increases the likelihood of unsatisfactory bacteriological tests and increases the construction requirements necessary for final acceptance. Refer to AWWA C651-92, Section 4, entitled "Preventive and Corrective Measures During Construction".

4. No contaminated material or any material capable of supporting the growth of microorganisms or causing taste, odor, or other aesthetic water quality concerns shall be used in sealing joints. Sealing material or gaskets shall be handled in a manner that avoids contamination. The lubricant used in the installation or sealing gaskets shall be Blue Lube or Slikstyx pipe gasket lubricant. Blue Lube Slikstyx are the only pipe joint lubricant for such use. It shall be kept clean and applied clean with dedicated applicators. (Note: Use of any unapproved lubricant other than Blue Lube or Slikstyx has been shown to cause significant taste and odor conditions when used in drinking water disinfected with chloramines. The County will not accept completed water lines that exhibit taste and odor conditions as a result of the use of unapproved lubricants.)
5. [Table 1, Flushing Schedule](#) gives flushing flow rates and flushing mechanism sizes for water mains 6" through 24" in diameter. Specific flushing schedules for line sizes above 24" will be project and site specific and directions will be given on the project drawings.

B. Filling and Testing Procedures:

1. Connection of the new water main to the existing distribution system for filling and testing shall be through a contractor furnished flushing mechanism as shown on [Standard Detail WAT-6](#) of these specifications and sized as noted in [Table 1, entitled "Flushing Schedule"](#). The contractor is to furnish the single gate valve, double check valve flushing assembly and all necessary fittings, reducers, increases and sleeves to make the piping connections. A suitable valued piping arrangement for the additions of the water-chlorine solution is to be available on the new line side of the flushing assembly. The assembly is to be furnished with 125 psi rated flange connections and installed in a manner approved by the Inspector.
2. Initial flush time is to be in accordance with [Table 1, entitled "Flushing Schedule"](#).

3. Pressure test the line as noted in [Section 3.02, A.1](#) of these specifications.
  4. Make any necessary repairs and pressure test again until the line passes this test.
  5. Disinfect the line in accordance with AWWA C651-92, Section 5. A water-chlorine solution prepared in accordance with [Section 3.03, A.3](#) above shall be used for disinfection.
  6. Bacteriological samples will be taken by the County in accordance with AWWA C651-92, Section 7.
  7. If unsatisfactory bacteriological test results are received, repeat steps 2, 5 and 6. Where only an unsatisfactory heterotrophic plate count is received, steps 2 and 6 need only be repeated at existing residuals.
  8. After receiving satisfactory bacteriological test results, the contractor shall coordinate with the Inspector the connecting of the new main to the existing system. All connecting pipe and fittings shall be clean and free of debris and shall be swabbed or sprayed with a 1 percent sodium hypochlorite solution before they are installed. The contractor shall tie-in new water lines to the existing water system within 10 working days of successful completion of all bacteriological tests, otherwise the disinfection process must be repeated.
  9. Final flush of line to be in accordance with [Table 1, entitled "Flushing Schedule"](#).
- C. The [Disinfection](#) and [Supplemental Procedures](#) as covered in sections [3.03](#) and [3.04](#) may be modified by the Director of Utilities for site specific problems that do not physically allow for following the normal disinfection procedures. Modified instructions will be given in writing from the Director through the Inspector and will be executed by the Contractor in a manner that does not subject the existing distribution system to undue problems and assures that adequate disinfection and flushing will be given to the new main.
- D. The procedure for the disinfection of short leads to fire hydrants and the connector pipe to fire suppression systems/ double check assemblies shall be as follows:

Connector piping, fittings and valves from an existing main to a fire hydrant or to a fire system double check assembly, which does not contain domestic use branches and is equal to or less than eighteen (18) feet in length from the main, may be spray disinfected or swabbed with a minimum 1 percent solution of chlorine just prior to installation, tied-in and flushed at a velocity of not less than 2.5 ft/sec. Bacteriological sampling will be taken downstream for confirmation.

E. Flushing:

Water for filling the line and flushing will be supplied by the Owner at no cost to the Contractor. Therefore, the use of water for making the new water line available for service will be as follows:

1. Initial Flush:

See [Table 1](#), entitled "[Flushing Schedule](#)". This is to be a high velocity flush through all sections of the new line. Since the large volume of water may have effects on the existing distribution system, the initial flushing is to be done only with the approval of and under the direction of the Inspector. System demands may cause this flushing to be done at times when the existing distribution system demands are low.

Because of the large volume of water to be flushed from the fire hydrants or flushing hydrants, the Contractor must inspect the areas of discharge and provide the necessary equipment or materials to prevent any environmental damage or erosion. Sufficient hose length and termination fittings are to be provided so as to discharge the water into stable, heavily vegetated areas, drainage ponds, storm sewers, paved ditches, etc. The contractor is to be responsible for any damage that may result from flushing.

2. Flush to remove disinfecting solution:

This is a low velocity, low flow, flush through fire or flushing hydrants to remove the disinfecting solution from the new line. In new subdivisions, or in areas where there is an existing sanitary sewer, this discharge may be made into the sanitary sewer system. The Contractor is to provide sufficient hoses to connect from the hydrants to a manhole in a manner that provides a suitable air gap for backflow prevention. In projects where there are no sanitary sewers, the flushing of the disinfecting solution must not enter any streams or be discharged in a manner that causes any environmental damage. For site specific locations the Inspector may require the use

of a neutralizing chemical and piping arrangement. (See drawing WAT-10, in Part II - "Standard Details" of these specifications). The expense of a neutralizing station is the responsibility of the Developer/Contractor. The Engineer shall indicate the need for a neutralizing station on the drawing.

### 3. Final Flush:

See Table 1, entitled "Flushing Schedule". The final flush is a medium velocity, medium flow flush to clear the line of any chlorine solution used in the tie-in and to provide for fresh water throughout the new lines.

**TABLE 1**

FLUSHING TABLE			
(Nominal) Main Size	Double Check Valve Single Gate Size (Note 1)	INITIAL FLUSH (Note 2)	FINAL FLUSH (Note 2)
		Min. Flow (gpm)	Max. Flow (gpm)
6"	4"	220	88
8"	4"	400	160
12"	6"	900	350
16"	6"	1500	624
20"	8"	2450	978
24"	12"	3525	1410
30"	Designed by Consultant	5505	2202
36"	Designed by Consultant	7935	3174

- NOTE:**
- 1) See description of "Preassembled Flushing Mechanism" Section II of the specifications, [Detail WAT-6](#).
  - 2) Approximation of flushing flows can be made by using either a pitot tube or a method of measuring the static discharge pressure from a hydrant used for discharge of the flushing water. See Section II of these specifications, [WAT-9 "Discharge Table for Hydrants"](#).
  - 3) On a case by case basis, dependent upon such variables as length of new waterline (<200'); space limitations; or other unforeseeable obstacles, the inspector may authorize the use of a smaller flushing device if the use of this device will provide for adequate flushing of the new waterline.

### 3.05 TESTING OF DOUBLE CHECK ASSEMBLY

- A. The County Inspector will be responsible for insuring the appropriate test is performed up to the OS&Y gate valve located on the inlet side of the double check assembly.
- B. The Fire Department will be responsible for insuring the appropriate tests are performed from the OS&Y gate valve located on the inlet side of the double check assembly to the building including the sprinkler system.
- C. The Developer is responsible for having the double check assembly tested by an approved tester prior to service being authorized to the building. Tests on the double check assembly will be conducted on an ongoing basis annually by a certified tester approved by the Cross Connection Control and Backflow Prevention Office of the Chesterfield County Department of Public Utilities. The results of the test will

be sent to the Backflow Prevention office and forwarded to the proper departments.

### **3.06 ABANDONMENT OF WATER SERVICE**

Excavate at the main and expose the corporation stop. Turn off the corporation stop and disconnect the copper tubing from the corporation stop. Assist the Inspector in referencing the location of the corporation stop for County records. Remove the meter box, yoke and service line. The Inspector will turn in the meter to the Operations and/or and Maintenance Center. When existing water services are to be abandoned as a part of a utility project, the Utility Contractor shall review the scope of the work with the Utilities Inspector and then proceed to abandon those services prior to any other work commencing.

### **3.07 ABANDONMENT OF WATER MAINS**

Water mains and hydrant laterals to be abandoned shall be permanently disconnected from the remaining system. If the abandonment takes place at a tee, the tee shall be removed from the main and straight pipe installed. For other instances involving fittings, the proper fitting shall be installed to eliminate the previous connection.

All open ends on abandoned pipe to be permanently sealed by plugging with masonry and/or mortar or plug. All valve boxes, fire hydrants, flushing hydrants (blow-offs) or other appurtenances to be removed. Salvageable fire hydrants are to be returned to the County's Utilities Operations & Maintenance Section.

### **3.08 CLEAN-UP**

Upon the completion of the installation of the water system and prior to the owner's final acceptance, sediment and debris shall be removed from the system. The work area shall be restored to its original condition and pavement replaced to the satisfaction of VDOT and/or County.

End of Section

## APPENDIX A

### VDOT, CHESTERFIELD RESIDENCY - JULY 2001

#### NON-THOROUGHFARE PLAN ROADWAY INSPECTION & TESTING REQUIREMENTS (Trench installation, Fill sections)

1. Roadways which are not defined as arterials or collectors in Chesterfield County's "Thoroughfare Plan", nor as arterials, rural collector or Virginia Byways as defined in Powhatan County's "Thoroughfare Plan" shall be constructed in accordance with all applicable sections of the current edition of *VDOT Road and Bridge Standards and Specifications*.
2. A licensed geotechnical engineer or certified technician under the direction of a licensed geotechnical engineer shall observe the placement of all storm sewer and utility trench backfill as well as installation of man-made fills.
3. Backfill of trenches and at junctions and appurtenances shall be placed in six (6) inch lifts compacted to four (4) inches.
4. Field testing of all storm sewer, utility trench backfill, and man-made fill shall be performed in accordance with the following criteria to insure that the density meets 95% of the standard Proctor dry density.
  - ? Tests shall be run between every 300' for roadways (fill sections). Testing on fill sections will be required to be approved prior to stone placement.
  - ? Tests shall be run between structures/appurtenances at 300 foot intervals with a minimum of one (1) test per run, and will be run in the top 1 foot of the backfill and below the base of the future pavement (trench installations). Testing on trench installations will not be required outside limits of pavement/curb and gutter. Testing on trench/utility installation will be required prior to pavement placement.
  - ? A minimum of one (1) density test shall be performed at each junction and/or appurtenance (trench/utility installations). Testing on trench/utility installations will be required prior to pavement placement.

5. All construction methods and materials shall be in accordance with all applicable sections of the current edition of *VDOT Road and Bridge Standards and Specifications*.
6. Corresponding sections of the *VDOT Construction Manual* are to be utilized as an additional reference source.
7. Inspection services shall be provided utilizing one of the following options:
  - ? The applicant may retain services of licensed geotechnical engineer (or technician under the direction of a geotechnical engineer) to perform required inspection and testing, or,
  - ? The applicant may request that VDOT provide inspection services through the establishment of an accounts receivable with the contractor responsible for providing all required material testing.
  - ? The applicant may request that VDOT accept a bond for a period longer than the standard one (1) year performance bond in lieu of either (A) or (B) above. Bonding periods of two (2) to five (5) years will be considered. (Surety rates in the amount of \$33/s.f. (fill sections) and \$67/l.f. for trench installations are anticipated and could be set up on an accounts receivable basis).
8. All testing reports, certifications and/or recommendations shall be submitted to VDOT for review and approval prior to proceeding with the next phase of construction.
9. Additional testing may be requested by the VDOT inspector as deemed necessary by field conditions (i.e. when failures are observed, when unacceptable construction methods are observed, etc.)
10. A licensed geotechnical engineer shall ascertain the cause and certify the method of repair for all pavement structural failures that occur prior to state acceptance.



**VDOT, CHESTERFIELD RESIDENCY - JULY 2001**

**THOROUGHFARE PLAN ROADWAY  
INSPECTION & TESTING REQUIREMENTS**

1. Roadways defined as arterials and collectors in Chesterfield County's "Thoroughfare Plan, and arterials, rural collectors and Virginia Byways as defined in Powhatan County's "Thoroughfare Plan" shall be constructed in accordance with all applicable sections of the current edition of *VDOT Road and Bridge Standards and Specifications*.
2. All construction methods and materials shall be in accordance with all applicable section of the current edition of *VDOT Road and Bridge Standards and Specifications*, as follows:
  - ? Inspection and testing of all fill embankments shall be performed in accordance with Section 305 of the current *VDOT Road and Bridge Specifications*, and,
  - ? Inspection and testing of all storm sewer and utility trench backfill shall be performed in accordance with Section 302 & 520 of the current *VDOT Road and Bridge Specifications*, and,
  - ? Inspection and testing of the aggregate base and asphalt surface course(s) shall be performed in accordance with Section 304, 309 & 315 of the current *VDOT Road and Bridge Specifications*.
  - ? Corresponding section of the *VDOT Construction Manual* are to be utilized as an additional reference source.
3. Inspection services shall be provided utilizing one of the following options:
  - ? Permittee may retain services of licensed geotechnical engineer (or technician under the direction of a geotechnical engineer) to perform required inspection and testing, or,
  - ? Permittee may request that VDOT provide inspection services through the establishment of an accounts receivable with the contractor responsible for providing all required material testing.

4. All testing reports, certifications and/or recommendations shall be submitted to VDOT for review and approval prior to proceeding with the next phase of construction.
5. Additional testing may be requested by the VDOT inspector as deemed necessary by field conditions (i.e. when failures are observed, when unacceptable construction methods are observed, etc.)
6. The aggregate base course shall be sealed immediately after placement through installation of the base asphalt course(s)
7. A licensed geotechnical engineer shall ascertain the cause and certify the method of repair for all pavement structural failures that occur prior to state acceptance.